Photometry and Colour.

For the more distant parts of the heavens proper motions are an uncertain guide, and we must depend on what can be learned from the light of the stars by means of stellar photometry, determinations of colour, and studies of stellar spectra. Speaking generally, we attempt to discover from the nearer stars sufficient about their intrinsic luminosities to enable us to use the apparent magnitude as an index of the distances of the stars which are further away. The most striking example is found in Prof. Hertzsprung's determination of the distance of the small Magellanic cloud. From a knowledge of the characteristics of the Cepheid variables found in this cloud by Miss Leavitt, and their apparent magnitude, he deduced the distance of the cloud as 10,000 parsecs.

Much attention has been given of late years to stellar photometry. In 1899 Prof. Pickering published the Revised Harvard Photometry giving the magnitudes of all stars brighter than 6·5m. In 1907 Messrs. Müller and Kempf completed a determination of 14,199 stars of the northern hemisphere brighter than 7·5m. In 1908 a catalogue of 36,682 stars fainter than 6·5m. was published at Harvard. These determinations derive additional importance as they give the means of standardising estimates of magnitude made by eye, particularly the many thousands of the Bonn Durchmusterung.

By the labours of Prof. Pickering and his colleagues at Harvard, Prof. Schwarzschild, Prof. Parkhurst at Yerkes, Prof. Seares at Mount Wilson, and others, the determinations of the magnitudes of stars by photography has made rapid strides. As yet no complete catalogues of photographic magnitude corresponding to the Revised Harvard Photometry have been published, though considerable parts of the sky and special areas, such as the Pleiades, have been carefully studied. The determination of the photographic magnitudes of any stars which may be required is, however, a comparatively simple matter when the magnitudes of sufficient standard stars have been found. A trustworthy and uniform scale has been to a large extent secured by the use of extra-focal images, gratings, and screens in front of the object glass, and the study of the effects of different apertures and different times of exposure.

At Harvard and Mount Wilson, standard magnitudes of stars near the north pole have been published extending to nearly the twentieth magnitude. In the part of the range extending from 10·0m. to 16·0m. these agree very satisfactorily. There is, however, a difference of 0·4m. in the scale between 6·0m. and 10·0m. which needs to be cleared up.

A uniform and accurate scale of magnitude is of fundamental importance in counts of the numbers of stars. Such counts aim at the determination of two things: (1) how the numbers vary in different parts of the sky, and (2) what is the ratio of the number of stars of each magnitude to that of the preceding magnitude in the same area of the sky. The counts of stars from the gauges of Sir William and Sir John Herschel, those of the stars contained in the Bonn Durchmusterung, those made by Prof. Celoria, and the recent counts of the Franklin-Adams plates by Dr. Chapman and Mr. Melotte, all agree in showing a continuous increase of stars as we proceed from the pole of the galaxy to the galaxy itself. The importance of this fact is that it shows a close connection between the Milky Way and the stars nearer to us. The Milky Way is not a system of stars beyond the others, but is the primary feature of our "island universe."

Photometric observations have acquired additional importance from the differences between photographic and visual magnitudes. The ordinary plate is more sensitive to blue light than the eye, and the difference between the photographic and visual (or photo-visual) magnitude of a star is an index of the colour. The colour index is found by observation to be related very closely to the type of spectrum. Prof. Seares has shown from the colour indices that as the stars become fainter they become progressively redder. Prof. Hertzsprung has found the same thing by the use of a grating in front of the object glass. Among stars of 17·0m. visual magnitude, Seares found none with a colour index less than 0·7; this is approximately the colour index of a star of solar type, *i.e.* near the middle of the range from blue stars to red stars.

There are three ways in which this may occur. The stars may be bright but very distant red stars; or they may be faint red stars, like those in the immediate neighbourhood of the sun; or there may have been an absorption of blue light. It is not possible to say in what proportion these causes have contributed. The red stars of 9·0m. and 10·0m. are nearly all very luminous but distant bodies, but it seems likely that stars of 17·0m. will contain a greater proportion of stars of small luminosity.

The absorption of light in space is very small, and as yet imperfectly determined. Prof. Kapteyn and Mr. Jones, by comparing the colour indices of stars of large and small proper motion, make the difference between the absorption of photographic and visual light as 1m. in 2000 parsecs. The question has been examined directly by Prof. Adams, who has obtained spectra of near and distant stars which are identical as regards their lines, and has examined the distribution of the continuous light. This direct method of comparison showed that the more distant star was always weaker in violet light. But as both these investigations show that very luminous stars are intrinsically somewhat bluer than less luminous stars of the same spectral type, the two causes require further research for their disentanglement. The question is of importance, as it may serve in some cases to determine the distances of very remote bodies the type of spectrum of which is known.

It must be admitted that we are as yet very ignorant of the more distant parts of the "island universe." For example, we can make little more than guesses at the distance of the Milky Way, or say what part is nearest to us, what are its movements, and so on. But, nevertheless, the whole subject of the construction of the heavens has been opened up in a remarkable manner in the last few years. The methods now employed seem competent to produce a tolerably good model showing the co-ordinates and velocities of the stars as well as their effective temperatures and the amount of light they radiate. Industry in the collection of accurate data is required, along with constant attempts to interpret them as they are collected. The more accurate and detailed our knowledge of the stellar system as it is now, the better will be our position for the dynamical and physical study of its history and evolution.

NOTES.

THE director of the Meteorological Office reports that information has been received from the Seismological Observatory at Eskdalemuir, Scotland, of the record of a large earthquake which occurred at 1 a.m. on Tuesday, September 7. The computed position of the epicentre is lat. 9° N., long. 86° W., with a possible error of 10°. The position mentioned is in the Pacific Ocean, about 70 miles from Cape Blanco in Costa Rica, and a circle of 10° radius drawn from this point as centre includes a portion of Central America and the Isthmus of Panama.

A REUTER message from Paris states that the Ministry of Foreign Affairs has sent to the Academy of Sciences a note reporting the discovery of mineral springs in Colorado containing radium in such large quantities that they may lead to the industrial extraction in America of radium, and the reduction of price to less than one-quarter the present rate per gram.

THE Ministry of Munitions announces that the Munitions Inventions Branch, which was recently constituted by the Minister of Munitions to deal with projects for inventions relating to munitions for warfare on land, or matters appertaining thereto, has now been removed from Armament Buildings, Whitehall, to accessible and commodious quarters in Princes Street, Storey's Gate, S.W. (hitherto the premises of the Whitehall Club), to which all future communications should be addressed. The department is now in working order, and is already dealing with a large number of proposals. The comptroller, Mr. E. W. Moir, is being assisted in this work by an advisory panel of scientific experts, whose names were announced in NATURE of August 19 (p. 678). This body is now at work in committees, and every proposal receives consideration from them.

IN commemoration of Capt. Cook, a tablet has been placed on the school at Great Ayton, Cleveland, where the navigator received his education; a scholarship has also been established at Marton, in the same neighbourhood, which was Capt. Cook's birthplace. The cost of both has been provided out of the surplus of the fund raised for the erection of the Cook memorial in London.

WE are informed that Mr. A. Gibb Maitland, Government Geologist and Director of the Geological Survey, Western Australia, has been appointed President of the Royal Society of Western Australia for the session 1915–16.

WE learn from the Allahabad *Pioneer Mail* that Dr. N. Annandale, superintendent of the Indian Museum, Calcutta, is to spend the greater part of his six months' leave of absence in Siam and Japan, studying the fauna of the lake regions, and that he will prepare and submit a report on the geological and entomological collections in the two countries referred to.

WE are glad to learn from Cambridge that the announcement in the *Times* of September 2 that Capt. James Romanes had been killed at the Dardanelles on August 31 is incorrect. A telegram from Gibraltar states that Capt. Romanes is returning home slightly wounded.

WE notice with much regret the announcement of the death, on September 4, at forty-four years of age, of Prof. D. T. Gwynne-Vaughan, professor of botany at University College, Reading.

THE death is announced of Julius von Payer, who, in a memorable Austro-Hungarian Arctic Expedition in 1872–74, under the leadership of Lieut. Weyprecht and himself, discovered and explored the coast of Franz-Josef Land.

THE death is announced of Mr. F. Higgins, chief engineer to the Exchange Telegraph Company. He began his career in the Post Office Telegraph Department, was Superintendent of Telegraphs in Mauritius for a time, and entered the service of the Exchange Telegraph Company in 1873, when he began to direct his attention to the development of type-printing telegraphs in the various forms now familiarly known as "tape" instruments. In this he was successful, as, besides perfecting several forms of "relays," he largely increased the speed of the instruments. In addition, he invented an instrument known as the column printer for printing on a broad band of paper. He was also the patentee of numerous inventions in electric fire alarms.

BY the death of Mr. Thomas Carrington-Smith agriculture has lost a prominent and characteristic personality, and one who did much to make British farming what it now is. He entered his farm about the middle of the 'fifties, and maintained an uninterrupted tenancy of some sixty years; thus he farmed through the prosperous times of the 'sixties, the disasters of '79, the depression of the 'nineties, and he lived to see high prices setting in once more. His long experience was placed ungrudgingly at the service of his fellow-agriculturists, and he played a considerable part in bringing about the legislation that was necessary before farmers could alter their systems of working. No industry is subject to more restrictions than agriculture, probably because farmers rarely work on more than an annual lease. Legislation is therefore necessary from time to time to effect adjustments of the various interests involved. In all this Mr. Carrington-Smith played a prominent part, and his name is associated with legislation affecting tenant right reform, swine fever, cattle disease, agricultural rates, and the sale of margarine. He was active, both on the advisory side, as chairman of the Dairy Products Committee of the Central Chamber of Agriculture, and on the administrative side, as a member of the Staffordshire County Council. He also wrote a number of papers on agricultural subjects.

WE announced, with regret, in our last number, the death of Mr. Henry Crookes, which took place after a short illness at his residence, 109 Ladbroke Road, W., on August 28. Henry Crookes was the eldest son of Sir William and Lady Crookes, and for many years he had been closely associated with his father in several branches of scientific activity. He was an associate of the Royal School of Mines, and was elected a fellow of the Chemical Society in 1902. Quiet and unassuming in disposition, his work was not largely known outside his immediate circle of friends and collaborators. Some years ago he spent a considerable time in South Africa, engaged in work connected with gold mining and the extraction of gold from residues by the cyanide process. At this time he unfortunately contracted intermittent fever, which necessitated his return to England, and the effects of which never left him. It is to this circumstance that his death at a comparatively early age is largely due. He contributed many papers to the scientific Press. Among them are the following:—"Action of Permanganate of Potash and Acetic Acid on Bacteria in Thames Water," "Bactericidal Properties of the Emanations from Radium," "Volcanic Dust," "Photographs and Living Cultures of Bacillus Phosphorescens," "Metallic Colloids and their Bactericidal Properties." Of late years his time was occupied chiefly in the analysis of the water supply of London and several large towns in the provinces, particularly with regard to their bacterial contamination. He was the discoverer of a process for the preparation of stable colloidal solutions of silver and other metals, the valuable properties of which are now recognised by the medical profession, and he was actively engaged upon these researches and preparations up to the time of his recent fatal illness. He will be greatly missed in his particular sphere of activity. In 1883 he married the daughter of the late C. E. Spagnoletti. Our sincere sympathy is offered to his widow, as well as to Sir William and Lady Crookes for their great loss at a time when they are naturally ill able to bear the strain.

CAPT. T. P. BLACK, whose death in the Dardanelles was announced in NATURE last week, was the eldest son of the late Mr. Geo. B. Black. Born at Shotts, Lanarkshire, in 1878, he was educated at Aberdeen and Darlington, gained a scholarship to Durham University, and graduated B.A., with honours, in 1898. At this time he visited the Dardanelles, Constantinople, Skutari, and the Crimea. On his return he graduated M.A. and B.Sc., with honours, at Durham, and researched on radio-activity. He next held a science research scholarship at Strassburg, taking the Ph.D. for original work in physics carried out under Profs. Braun and Zenneck. An abstract from his doctoral dissertation, published in the *Annalen der Physik* for January, 1906, bore the title, "On the Resistance of Coils for Quick Electric Oscillations." After being an assistant at Newcastle, he became in 1906 lecturer and demonstrator in physics at University College, Nottingham. While here he was joint author of an "Introduction to Practical Physics." He was justly valued as an able teacher, and was deservedly popular with staff and students. In 1911 he accepted the registrarship of the college and so passed to new successes in a wider sphere of usefulness. Thus his soldier's death was but the crowning glory of a strenuous life, rich in distinction and promise.

THE first number of the Journal of the British Science Guild, which has just been issued, contains a verbatim report of the ninth annual meeting of the guild, held on July 1, and the address on "The National Organisation of Science," delivered on that occasion by Sir William Ramsay. It is hoped that the publication of the Journal will serve not only to keep members in touch with the results of the guild's activities in many directions, but also will be the means of securing increased support for its work. The main purpose of the guild is the promotion of scientific method and organisation in all national affairs; and there are sufficient sympathisers with this aim to increase the membership a thousandfold. The minimum annual subscription is only half a crown; life membership is obtained for two guineas, and the subscription for a life fellow is ten guineas. Any British subject is eligible to join the guild, and all who believe in the services which science can render to the arts of peace as well as those of war should give a practical sign of their conviction by becoming members or fellows. The offices of the guild are at 199 Piccadilly, London, W., and the secretary will be glad to send particulars of committees and of publications upon application.

IN the *Times* of September 4 Mr. R. C. Shaw announces the discovery at Caervoran, on the Roman Wall three miles east of Gilsland, in Northumberland, of a remarkable bronze measure of the Roman period. Such officially certified measures are very rare. On the present specimen the name of the Emperor Domitian, in whose consulate in A.D. 90 the measure was tested, has been obliterated, owing to the hatred felt towards him after his death. The measure contains 17½ sectarii, about 30 lb. of wine, or rather more than two gallons, and 8 lb. have been allowed as the weight of the material. Prof. Haverfield is uncertain whether it was really certified under the order of the Emperor, or whether it is a private venture, masquerading as official. In any case, there is no question of the date, and the discovery is of considerable antiquarian interest.

IN *Man* for September Mr. R. Grant Brown discusses the modesty of Burman women. He points out a fact familiar to all visitors to a religious fair in northern India, that women when bathing manage their scanty drapery with such dexterity that any suggestion of immodesty is avoided. The principle underlying this observance of propriety is that every Burman lady believes herself to be under the watch of twelve spirits, six of whom are good and six evil, and it is supposed that any exposure of the human form in their presence is a source of danger. Even in the wearing of the scanty tamein, or waist-cloth, she contrives to observe the laws of propriety. The only case in which decency is violated is when a woman really loses her head in the course of a quarrel with a neighbour, and both combatants roll in the gutter without any regard for decency. The explanation is that they believe that in thus humiliating an opponent they have vindicated the justice of their cause and brought the enemy into contempt.

A PAPER entitled "The History and Functions of Botanic Gardens," by Mr. A. W. Hill, assistant director of the Royal Gardens, Kew, was read by invitation at the twenty-fifth anniversary celebration of the Missouri Botanic Garden, October 15, 1914, and has been reprinted from the Annals of the Missouri Garden (Vol. ii., pp. 185–240). This paper is mainly devoted to an extremely interesting and valuable historical summary of the founding of the various botanic gardens of the world from about the year 1000 B.C. onwards, and is illustrated by nine plates, three of which are remarkably fine collotype reproductions of photographs taken in Kew Gardens.

Two important papers appear in the *American Naturalist* for August. The first of these should be carefully read by all who are interested in problems of heredity. Herein Mr. E. M. East discusses at some length "The Chromosome View of Heredity and its Meaning to Plant-Breeders." He contends that the maximum possible difficulty in the improvement of animals, and plants, by hybridisation, usually depends directly upon the chromosome number. This being so, then there can be no question as to the importance of determining the number of chromosomes in a species before beginning a complex plant-breeding problem, and thus being able to comprehend the maximum possible difficulties that may be encountered. In the second paper Prof. A. C. Eycleshymer discusses the origin of bilaterality in vertebrates. From a study of the early embryonic stages he is of opinion that neither the position nor the direction of cleavage grooves has the slightest significance as far as the setting apart of definite embryonic areas is concerned. And further, that neither the position nor the direction of the cleavage grooves enables one to predict the long axis of the embryo, so that other phenomena, which may be of service, must be looked for. These he finds in the increased cellular activity of the active pole, which can be located with the advent of the first cleavage groove. This marks the head end of the embryo. The tail end is similarly marked by the early accelerated activity of the side of the egg, indicating the forthcoming blastopore, which definitely fixes the posterior end of the embryo. It necessarily follows that the median plane of the embryo must coincide with a line passing through the centres of the two.

THERE is much that may be profitably ruminated on in the *Museums Journal* for August, even by those who have no part in the conduct of museums. More especially we refer to the views expressed at the conference of the Museums Association held in London during July, as to the relation which should exist between museums and the various grades of educational institutions. In Manchester, where so many of the school buildings have been converted into military hospitals, a number of teachers have been sent to the museums to receive a thorough course of instruction on the various aspects of the museums to which they are sent, in order that, when peace returns to us, they may the more efficiently utilise the museums as sources of education. Many valuable suggestions for the further widening of the spheres of usefulness of museums were also made, some of which, at any rate, might well receive immediate attention. The address of the president, Mr. E. Rimbault Dibdin, might be read with much profit by the peace cranks who just now are so busy.

MR. G. B. WALSH makes some interesting observations on the causes determining the survival and extermination of insects in the manufacturing districts of Yorkshire in the *Entomologist's Monthly Magazine* for August. Drainage, cultivation, and moorland fires have done much, but blast-furnaces and chemical works have done more, to bring about the extinction of many insects that were once common in the areas surveyed. Some have contrived to thrive under the most adverse conditions. Thus he relates how two very local beetles, moorland species—*Miscodera arctica* and *Pterostichous vitreus*—are to be found, in some numbers, in a marsh traversed by a fœtid stream, and stinking most abominably of hydrogen sulphide. A slag heap bounds the marsh on either side, which receives the overflow from a neighbourhing chemical works, while dust from calcining and blast-furnaces fills the air, which is saturated with the odour of rotten eggs. How insects the natural home of which is the breezy moorland can contrive to thrive under such appalling conditions is indeed a mystery. Specimens taken from this new habitat should be carefully compared with others obtained from the moorland to discover, if possible, whether any adaptations to the new environment have taken place.

THE accurate zoning of Carboniferous strata in the British Isles has received general attention since the pioneer work of A. Vaughan on the Avon section. L. B. Smyth, lecturer on palæontology in the University of Dublin, has now (Sci. Proc. R. Dublin Society, vol. xiv., 1915, p. 535) cleared up some obscure points in the sequence in the north of the county of Dublin, where a river from the Devonian land-surface entered the Carboniferous sea. A correlation is made between these Irish deposits and those of the English Lake District, described by E. J. Garwood. Several new species of corals, and a new genus, Arachniophyllum, are described. The old Arachnophyllum, by the by, has been absorbed in Strombodes; but it might have been well to direct attention to this, the new generic name being almost identical.

FROM a new consideration of the "Interglacial Gorges of Six Mile Creek at Ithaca, New York" (Journ. of Geology, vol. xxiii., 1915, p. 59), J. L. Rich and E. A. Filmer conclude that at least three glacial epochs are indicated, "separated by periods of time longer than that since the last epoch." The great Wisconsin ice-extension entered the interglacial stream-gorges, and deposited its drift there, without appreciably modifying their walls.

F. CHAPMAN describes a new genus of dibranchiate cephalopods, Notosepia, from the Oligocene of Victoria, Australia (Proc. R. Soc. Victoria, vol. xxvii., 1915, p. 357). Young forms have a recurved mucro at the termination of the pro-ostracum, recalling the Eocene Belosepia, while this becomes, in adult specimens, straightened towards the type known in the modern Sepia.

STUDENTS of meteorites will be glad to note the record of the rare calcium sulphide, Oldhamite, which crystallises in the cubic system, in the "carbonaceous chondrite" of Indarch, Russia (G. P. Merrill, Proc. U.S. Nat. Museum, vol. xlix., 1915, p. 109). Mr. Merrill quotes its occurrence in five other meteorites of varied composition, and points out that it may prove to be more widely diffused, since it is usually inconspicuous.

THE use of antiseptics or disinfectants for the treatment of wounds is limited by several factors. Thus many potent germicides may be irritating to the tissues and poisonous to the system, *e.g.* mercuric chloride. The efficiency of a disinfectant is probably always reduced more or less by the albuminous constituents of the discharge from the wound. In a paper entitled "On the Use of Certain Antiseptic Substances in the Treatment of Infected Wounds" (*Brit. Med. Journal,* August 28, 1915, p. 318), by Dr. H. D. Dakin, of the Herter Laboratory, New York, some of the limitations of the commonly-used substances are detailed, and means for obviating them are discussed. Thus hypochlorite of soda is very active, but always contains free alkali, which is irritating. If, however, it be mixed with a weak polybasic acid, the latter will neutralise the free alkali without decomposing the hypochlorite. A solution of suitable concentration for direct application to wounds, containing 0·5–0·6 per cent. of sodium hypochlorite, may be prepared as follows:—140 grams of dry sodium carbonate (Na_2CO_3), or 400 grams of the crystalline salt (washing soda) is dissolved in 10 litres of tap-water, and 200 grams of chloride of lime (bleaching powder) are added. The mixture is well shaken, allowed to stand for half an hour; the clear liquid is then syphoned off from the precipitate of calcium carbonate and filtered through cotton-wool. To the clear filtrate 40 grams of boric acid are added, and when dissolved the resulting solution is ready for use, but it should not be kept longer than one week. It may be used for continued irrigation of wounds up to 1, or even 2, litres a day without harm. Other chlorinated organic compounds (certain chloroamides) are also being tested.

DISCUSSIONS of the anemographic observations recorded at Jubbulpore from May, 1889, to April, 1900, and at Belgaum from May, 1881, to April, 1904, are given as Nos. 5 and 6 of the Memoirs of the Indian Meteorological Department, vol. xix. The discussions have been carried out by W. A. Harwood, and an introduction is given by Dr. G. T. Walker, Director-General of Observatories in India. Some notes were left by Sir John Eliot on the Belgaum observations. Faulty exposure and inefficient working are alluded to as occasioning some discrepancies. Jubbulpore is at an elevation of 1327 ft. above sea-level, and a detailed description is given of the station. The climate is divided into three seasons: the dry, cool season, from October to February; the dry, hot season, from March to May; and the rainy season, from June to September. The variation of wind direction and velocity is given for each of these seasons and for the year, also for the several hours in each month, and details are shown both in a tabular form and graphically. Storm winds are also dealt with. Belgaum is 2539 ft. above sea-level, and the observations are similarly treated to those at Jubbulpore, the discussion being made separately for the cool season commencing in October and ending in February; the hot season in March, April, and May; and the south-west monsoon season in June and September.

IN the Journal of the Royal Statistical Society for July Mr. S. Rosenbaum analyses the effects of the war on the overseas trade of the United Kingdom. In order to estimate the probable value of the trade in each of the five months, August-December, 1914, if no war had taken place, the trade in January-July is multiplied by the average ratio, for each of the months, in the years 1904–13. A basis is thus obtained for separating, approximately at least, the effects of the war from the normal course of trade. So estimated, the collapse of the export trade due to the war was about 97,000,000*l.* in the first five months—a decline that was widely spread over nearly all classes of exports. If exports are valued on the basis of peace prices this decline is slightly lessened. Of the total export trade lost about 22,000,000*l.* would have taken place with enemy countries. As regards imports, the shrinkage was approximately 67 millions, or about one-fifth of the expected imports, but the ratio was a steadily declining one. It must be remembered, however, in this case that a considerable rise in prices partly masked the decline; in volume the decline must have been about one-fourth. Details are given in the paper for the several classes of exports and imports, and in the latter part some analysis is presented of the figures for January–April, 1915. During these months the state of affairs was largely altered. While exports were still heavily down, in February, March, and April the value of imports was greater than in the corresponding months of 1914, and this was a real increase, not in values only, but also in volume.

IN the same issue of the Journal there is a paper by Mr. Bernard Mallet and Mr. Strutt, in continuation of a paper published by Mr. Mallet in 1908, on the multiplier necessary for converting the value of estates passing at death, and declared for estate duty, into the value of capital wealth in the hands of the living. The value of the multiplier, 24, reached in the earlier paper was thought on several grounds to be too low, and the problem has now been re-attacked. The chief source of error was the assumption of too high a rate of mortality. Taking figures more nearly corresponding to the estate-leaving class the multiplier is raised to 28. Rather unexpectedly an often-suggested source of possible error—gifts *inter vivos*—it is argued, does not, in fact, affect the results, though this conclusion was disputed in the discussion that followed. A further amendment of the mortality rates used, made in reply to criticisms offered, suggests that the multiplier might be further raised to 30. Even this multiplier gives a value of total capital in the hands of the living of only 10,776,000,000*l.*, a value some two or three thousand millions less than that of several other estimates.

IN his concluding article on modern bullets in war and sport in *Engineering* for August 27, Fleet-Surgeon C. Marsh Beadnell says that hard-nosed bullet wounds of the lung are not as a rule fatal. When a hollow organ such as the stomach is perforated by a bullet, it sustains more damage if it contains fluid than if empty. The author fired a 0·303 bullet at a sheep's stomach, in the one case when it was full of water, and in the other case when empty, with the following results. The aperture in each wall of the empty organ was 0·2 in.; the aperture in the first wall of the full stomach was also 0·2 in., but that in the second wall was 0·7 in. From this it follows that a man hit after a full meal would have less chance of recovery than had this occurred when the organ was empty. Bullet wounds of the lung, provided no large vessels are touched, are seldom fatal in man or beast. The author has seen as many as a dozen men in one ward of a base hospital all convalescent from lung injuries.

IN an article in *Engineering* for September 3, Mr. William Hovgaard discusses the *Lusitania* disaster, and draws therefrom the following conclusions:—(1) The principle of transverse subdivision should be considered as fundamental in the design of all vessels, merchant ships as well as warships, simply because the longitudinal stability is always much greater than the transverse, and in sea-going ships is generally about one hundred times as great. (2) Longitudinal subdivision is intrinsically pernicious, on account of the small transverse stability of all ordinary vessels, and should be used only where absolutely necessary. (3) All wing compartments, where such must be fitted, should either be so small that their heeling effect when flooded will be negligible, or, if that is impracticable, as may be the case in warships and auxiliary cruisers, they should be in permanent connection with corresponding compartments on the other side of the ship, so as to eliminate the heeling effect automatically. Provision may be made, in addition, for pumping water into the side compartments. In pure merchant vessels, no side bunkers or other longitudinal compartments of so large a volume as to require such means of compensation should be allowed.

THE *Engineer* for September 3 has an article on the employment of women as machinists, with special reference to the various shell factories organised by Sir William Beardmore. About 800 girls are now employed in these factories, and the number will shortly be very largely increased. Some of these girls have now been at work for about four months, and were first trained by special instructors selected from men employed in other departments of Messrs. Beardmore's works, assisted by skilled operators sent down by the makers of several of the machines. These girls were found to be capable of a good output on many of the operations after only a week's instruction. Lady superintendents are in charge of the place night and day, and a good mess-room is provided for meals. All the operations, with one exception, in the making of 18-pounder shells are carried out by the girls. The output on some of the operations exceeded expectation owing to the keenness of the girls, so much so that some of the machines provided have actually been found to be superfluous, and other machines have been shown to be capable of more work than had ever been believed to be possible. There is plenty of such labour available in the country, and all the women are moved by the keenest spirit of patriotism. We trust that employers will not hesitate to fill in their blanks from this source.

MOTOR barges, which stir up the mud and discharge large quantities of oil in the Grand Canal, in the neighbourhood of Ballinasloe, Co. Galway, will apparently soon bring about the extinction of some of the rarer aquatic mollusca. This at any rate is the opinion, founded on experience, of Mr. R. A. Phillips, who contributes a short but valuable account of the mollusca of South Galway to the *Irish Naturalist* for August.

OUR ASTRONOMICAL COLUMN.

COMET NOTES.—Comet Mellish (1915 *a*) is moving north and towards the earth, and will be nearest about October 26 (47 million miles). It is also rapidly getting away from the sun, and its brightness is diminishing. J. Braae and J. Fischer-Petersen have extended the ephemeris given in *Astronomische Nachrichten* 4802. The comet is apparently moving nearly parallel to and only slightly S. of the line joining β Canis Majoris and β Orionis. It will make very close approach to each of these stars on September 27 and November 5 respectively. During this time its magnitude will have reduced from 7·7 to nearly 8·3. J. Braae also supplies a continuation of the ephemeris for the periodic comet Tempel II. (1915 *c*). Dr. H. Thiele, of the Bergedorf Observatory, publishes (*Astronomische Nachrichten* 4811), positions measured on August 9 and 10. It is now somewhat distant and retiring. Its declination is slowly decreasing on a path in Taurus, practically at right angles to that of 1915 *a*. For the other periodic comet at present in apparition, Winnecke's comet (1915*b*—this return was first observed by Dr. Thiele just mentioned), K. Hillebrand has extended the ephemeris given in *Astronomische Nachrichten* 4787, using slightly improved places (*Astronomische Nachrichten*, 4810). This comet has also passed perihelion, and does not come nearer than the sun's distance (about September 25). Its apparent path passed near κ Virginis (August 31), and from Virgo passes through Libra and centrally through Scorpio, bringing it near ϵ Scorpionis on October 4. During the last apparition (as 1909 *d*) it remained very faint and without observable tail or nucleus.

THE TOTAL SOLAR ECLIPSE, AUGUST 21, 1914.—Several publications dealing with this eclipse have lately come to hand. In one of these, MM. C. Benedicks and I. Fredholm describe (Ark. K. Svenska Vet' Acad., Band 10, No. 24) some photographs taken at Lundsvall with a telephoto combination (Goerz anastigmat and Zeiss teleansatz). They have devised a laboratory experiment reproducing the effect of shadow-bands which they ascribe simply to an effect of refraction in a non-homogeneous medium. Senor P. Carrasco forwards a reprint of a note referring to his observations made at Theodosia of the red line at λ 6373 (Revista R. Acad., Ciencas, January, 1915, Madrid). From Prof. Guglielmo Mengarini we have received a copy of an article which appeared in the *Nuova Antologia* (fasc. 1039, Rome), describing the operations of the Italian expedition to the Crimea. Although occupying a station in the neighbourhood of Theodosia, a fortunate break in the clouds permitted observations of totality, and the corona was photographed by Prof. Mengarini on a Lumiere autochrome plate, exposed at the focus of the Fraunhofer equatorial (3 metres f. l.) loaned by Prof. Bemporad. Illustrations include reproductions of two composite corona photographs and some prominence pictures. Prof. Ricco made visual and spectroscopic observations. Prof. Palazzo employed a series of recording instruments in observations of solar radiation, terrestrial